

**Movements and activity patterns of luderick
(*Girella tricuspidata*): drivers and spatial scales**

by

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CERTIFICATE OF AUTHORSHIP/ORIGINALITY

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I certify that the work in this thesis has not previously been submitted for a degree nor has it been submitted as part of requirements for a degree except as fully acknowledged within the text.

I also certify that the thesis has been written by me. Any help that I have received in my research work and the preparation of the thesis itself has been acknowledged. In addition, I certify that all information sources and literature used are indicated in the thesis.

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GENERAL ABSTRACT

A thorough knowledge of fish movements and the factors influencing them is essential to understanding the ecology of a species, and underpins effective management actions and planning. This thesis aims to understand the movement patterns of the temperate fish species luderick (*Girella tricuspidata*), which inhabits estuaries and near coastal shallow rocky reefs of New South Wales (NSW; SE Australia) and is of high commercial and recreational fishing interest. Although the biology and ecology of this primarily herbivorous teleost fish are already documented, movements and their drivers are poorly known.

I used acoustic telemetry to address different aspects of the movements of mature luderick at various spatio-temporal scales. Using an extensive collaborative network of acoustic receivers spread along the NSW coast and in selected estuaries, I identified that large freshwater inflows resulting from heavy rainfalls were the main drivers of luderick estuarine movements: (i) they triggered fish departure from the systems and coastal migrations; (i) these events and associated changes in conductivity drove movements along estuaries; (i) and luderick decreased swimming activity and shifted in depth during high flow events.

Tagged luderick detected outside their tagging estuary (13 out of 61 individuals) migrated predominantly in a northward direction, suggesting spawning migrations. Luderick travelled up to 492 km, and at speeds exceeding 57 km d⁻¹. This swimming velocity corresponds to the optimal metabolic speed estimated in laboratory experiments. Migrating luderick could visit multiple estuaries, and individuals from different estuaries converged to similar coastal areas, providing further understanding of luderick estuarine connectivity. Partial population migration may explain the inter-individual variability in estuarine residency and large-scale movements of luderick. This behaviour may provide further resilience to harvesting and changing environments.

Strong diel and sub-diel rhythms in activity were found, with luderick being more active during the day compared to the night. Luderick field metabolic rates increased from dawn and throughout the day, until they declined after dusk, which could be related to diurnal foraging activity and nocturnal sheltering behaviour.

Swimming activity decreased with temperature, and while effects of seasonality could not be fully addressed in this study, it is predicted that movement patterns of luderick would vary across seasons and years, driven by fluctuations in temperatures and rainfall regimes.

This thesis provides an understanding of luderick movement patterns and their drivers, and shows that luderick respond to changing environment by adopting a range of behavioural responses. These findings will improve the management of this species and its fishery.